JPEG 2000 Part 2 Progress Report: Even Length Filters

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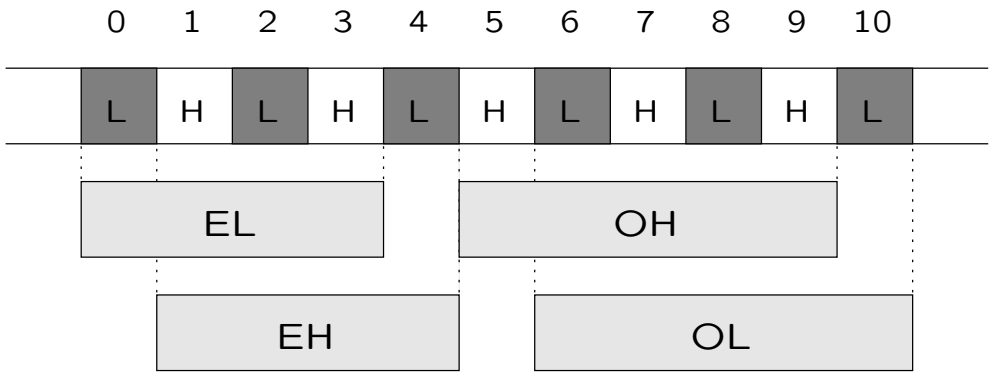
Overview

- Review of proposed algorithm
- Status of even-length filter banks in VM8.5
- Experiments to be performed
- Lifting implementation progress

Notation for Transform Cases

- Even-length filter banks need both lowpass-first and highpass-first algorithms for both even- and odd-length signals - imposed by canvas co-ordinate system

- Notation:



Transform Definitions for Even-Length Filter Banks

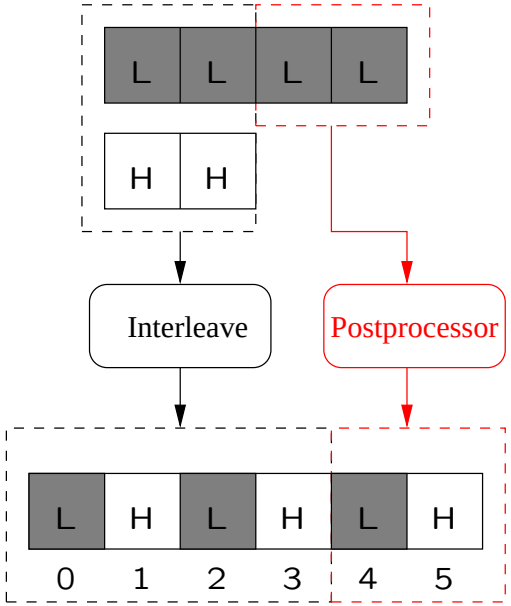
- All input vectors extended by (2,2)-symmetric extension
- Transform defined as follows:

Transform	Lowpass, Highpass Centres	Postprocessing at right
EL	$+\frac{1}{2},\ +\frac{1}{2}$	$(L,L) \rightarrow (L,H)$
EH	$-\frac{1}{2},\ -\frac{1}{2}$	
OL	$+\frac{1}{2},\ +\frac{1}{2}$	
OH	$-\frac{1}{2},\ -\frac{1}{2}$	$(L,L) \rightarrow (L,H)$

- These choices satisfy resolution scalability and support transform domain geometric manipulation (see *WG1N1842*).

Postprocessing Concept

- Example of postprocessing at right end of **EL** transform



- Variety of options exist; VM8.5 uses a 2-point Haar at present

VM8.5 Even Length Filter Bank Support

- Convolutional implementation only; **-Fconv** must be used on compress and expand

- Two-point transform is easily modified - implemented in functions *analysis_end_filter* and *synthesis_end_filter*

- Two-point transform in VM8.5 is

$$\begin{aligned} L' &= (L_{N-1} + L_N)/2 \\ H' &= L_{N-1} - L_N \end{aligned}$$

VM8.5 Even Length Lifting Kernels

- New even length *float_lifting* kernels have been modified from *int_lifting* kernels:

  kernel-002 2-6 filter bank
  kernel-003 2-10 filter bank
  kernel-004 2-2 filter bank (Haar)

Necessary experiments

- Details of two-point transform need to be finalised
  - Channel gains?
  - Omit modification of last lowpass sample?
- Possibility of phase distortion for definition currently in VM8.5
- Need to switch group delay conventions for lowpass/highpass first transforms and move 2-point transform to the left boundary to comply with other filter bank constraints
- Slight SNR differences for different options
- Objective and subjective distortion evaluations required by WG1 from core experiment partners SAIC and Ricoh

Additional experiments

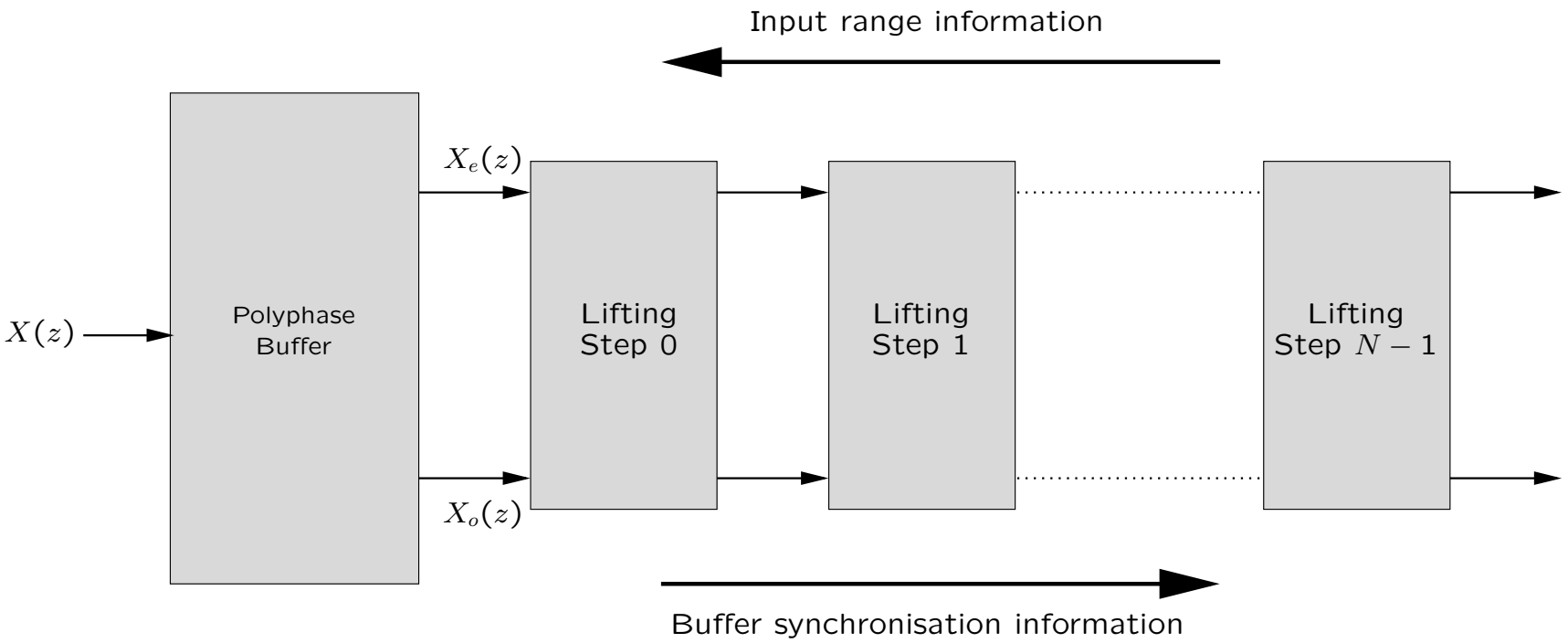
- Superior coding performance for subbands with W symmetry?

- Objective and subjective distortion experiments necessary; partners required for experiments

Lifting Implementation

- Analysis part of new implementation nearly complete
- Existing VM lifting code very difficult to modify compared to convolutional code
- Limited memory model of current VM necessitates complex lifting implementation in vertical direction

Lifting Analysis Structure



Conclusions

- Independent evaluation from core experiment partners required to complete the core experiment for New Orleans

- Topic for discussion: should we consider a "Part 2 VM" that directly implements all of the significant extensions in Part 2 using a more user friendly software design?